EXTRACTION AND CHARACTERIZATION OF MONTMORENCY (*PRUNUS CERASUS*) SOUR CHERRY PIT OIL

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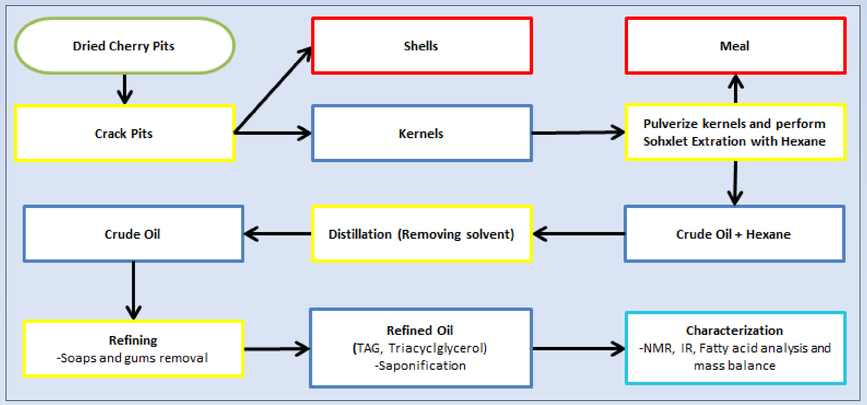
INTRODUCTION

The United States currently produces the Montmorency sour cherry (*Prunus cerasus*) in amounts of 200-250 million pounds per year with the largest producer being Michigan. The cherry fruit is primarily consumed in the food industry in products such as pie and juice, while the unused pits (~40 to 50 million lbs) remain an under-utilized byproduct. The pits are currently used primarily as filler in cement manufacturing or are disposed of in a land-fill.

Natural oils and fats, such as the cherry pit oil, consist primarily of triacylglycerols (TAGs), with a few major vegetable oils of commerce being soybean, canola, peanut and coconut oil. The glycerol portion of TAG is constant in all oils and fats, whereas the fatty acid structure and position of esterification on glycerol differ with different oils. The most common saturated fatty acids are palmitic (C16:0) and stearic (C18:0), while the most common unsaturated fatty acids are oleic (C18:1), linoleic (C18:2), and linolenic (C18:3) acids, all of which were found in the cherry oil.

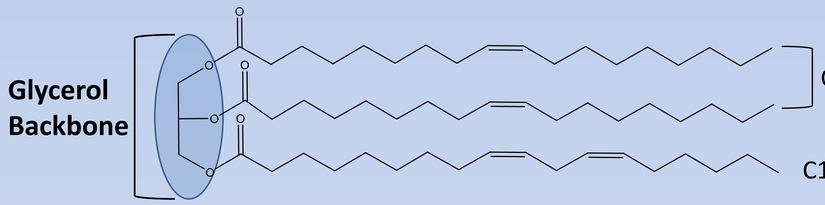
EXTRACTION

The cherry pits were cracked using a pneumatic press and the kernels were separated by a density gradient formed using a brine solution (SG=1.3). The kernels were rinsed, dried in an oven at 105˚C for 12-24 hours, and then pulverized using a mill. The pulverized kernels were extracted with hexane in a Soxhlet for 24 hours. The solvent was removed with a rotary evaporator, giving the crude oil.

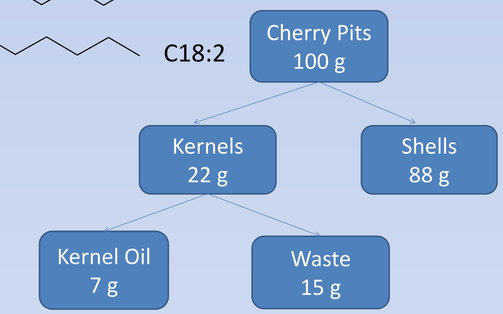


ANALYSIS

The oil yield was found to be 7% by mass from the uncracked pits, which is similar to previously published results [2]. The fatty acid composition of the oil was determined by gas chromatography (AOAC method 996.06) and listed in Table 1 along with the literature values for comparison. The minor component analysis, as analyzed by gas chromatography [3], provided tocopherol and sterol concentrations (vitamin E active) in appreciable amounts (see Table 2).



Above: One possible structure supported by NMR and FAD containing two oleic fatty acids and one linoleic fatty acid.
Right: Mass balance of oil extraction.



(Table 1) Fatty Acid Distribution (FAD) of *Prunus cerasus* oil of the current study (grown in Utah) compared with the literature report (from Romania)

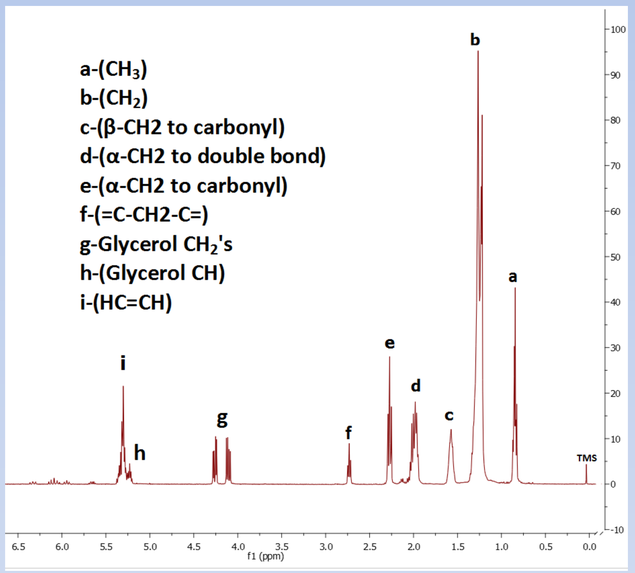
Fatty Acid	Current Study (Utah) (wt %)	From Literature[2] (*Romania*) (*wt %*)
C16 Palmitic	7.67	11
C18 Stearic	2.45	6.4
C18:1 Oleic	48.95	42.9
C18:2 Linoleic	32.11	38.2
C18:3 α-Linoleic	0.12	-
C20 Arachidic	1.01	0.9
C20:3 Eicosatrienoic	4.23	-
Other Fatty Acids	3.4	0.5
TOTAL	99.94	99.9

(Table 2) Minor Components (Tocopherols and Sterols) from the unsaponifiable matter of *Prunus cerasus* oil compared with soybean oil.

	Prunus cerasus, Utah (ppm)	Soy Bean Oil[4] (ppm)
δ-Tocopherol	64.2	950
γ-Tocopherol	400	900
α-Tocopherol	61	100
Campesterol	159	680
Stigmasterol	7.2	640
B-sitosterol	3610	1830
Other Sterols	1710	120

DISCUSSION

The presence of eicosatrienoic acid (EtA, C20:3ω 3) in *Prunus cerasus* oil was an interesting discovery as it is an essential ω-3 fatty acid; an intermediate in the biosynthesis of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Both EPA and DHA play a crucial role in the cognitive functions of the body (eye, brain and nervous system). Tocopherols, which are known antioxidants useful in dietary supplements as well as the cosmetics industry, were found in appreciable amounts. With a high tocopherol content, the oil shows potential for use in cooking applications by having both increased oxidative stability as well as nutritional value.



Above: NMR spectrum of cherry oil with corresponding assignments.

SUMMARY

The cherry pits, a byproduct of cherry fruit processing, are an underutilized resource containing 7% oil. This oil was extracted and analyzed for its chemical composition with the results showing an appreciable amount (4.3%) of the unusual and essential ω-3 fatty acid, eicosatrienoic acid. In addition, the oil also contained sterols and tocopherols which are useful as dietary supplements. In particular, there were high concentrations of the γ- and δ-tocopherols that are known to provide high oxidative stability. Based on the chemical composition, the cherry pit oil has potential applications as a cosmetic ingredient or a dietary supplement.

ACKNOWLEDGEMENTS

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